1986 Quinquennial Review

BACKGROUND PAPER No.5

Trends in the Utilization of Office Space

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1 Background and Summary

1.1 The 1986 Quinquennial Review: Background Papers

The 1976 amendments to the Part I Plan for the Central Area put in place provisions which require, among other things, a review at five year intervals of certain aspects of the Plan and in particular, of indicators relating to the Plan's office deconcentration policies. A ten year review of these indicators is due in 1986. As part of the monitoring and research leading to the review, a series of background papers are being published dealing with a range of factors related to the rate and distribution of office, employment and population growth. Additional papers will also examine the impact of these factors on the growth of employment and related impacts on the transportation system.

The subject report, **Trends in the Utilization of Office Space**, comprises Background Paper No. 5. The report examines recent occupancy patterns in the office sector and explores historic trends in Floor Space per Worker (FSW) ratios, as required by Section 1A.5(b)(iii) of the Plan.

1.2 Executive Summary

The Floor Space per Worker ratio for the Central Core has risen since 1975 from 22.9 to 26.0 square metres per office worker. Factors that have contributed to the rise in the FSW ratio include the following:

- An increasing proportion of Central Area office employees in the managerial and professional classes, which typically have higher FSW ratios.
- The strong demand for office space in the Core which has outstripped office employment growth by a considerable margin contributing to the increase in the Core FSW ratio.
- An abundant supply of vacant office space and a wide variety of tenant inducements which, in recent years, have led to greater tenant mobility and increased consumption of space for firms in the Core.
- The technological impacts of office automation on the functional operations of office work which have facilitated the decentralization of lower order (clerical) "back-office" functions to suburban locations and have also contributed to increases in the space requirements of the higher order (managerial/professional) functions that remain in the Core.
- A tripling of office rents in the Core since 1977 which may have accelerated the displacement of back-office functions from the Core.

Analysis of current findings displays no evidence relating observed FSW values to building size, age of building or location. More important determinants are the type of functions taking place within the buildings.

2 Office Occupancy Characteristics

2.1 The Floor Space per Worker Index

The Floor Space per Worker Ratio is an indicator used to measure the intensity to which commercial buildings are utilized. This measure of the average number of square metres per employee has, in the past, been determined by surveying a sample of firms regarding the number of employees and the floor space the firms occupy.

There is no *standard* measure of FSW, although the prevailing average in a market area is often used by office leasing agents in helping clients locate appropriate space for their operations. Major corporations, with some idea of how their workforce will be growing in the future, can apply such an indicator in a sensitivity test to estimate when overcrowding will become a problem and to plan the acquisition of an appropriate amount of additional floor space.

When an FSW figure is quoted for an area, such as the Central Core, it represents the average measured over the sample of firms, or buildings, observed within that district. Why should we be interested in this figure? The average FSW ratio has been used to estimate the *employment* impacts of *commercial* development proposals in the same manner that one would use an indicator of average household size to estimate the *population* impacts of new *residential* development.

The Central Area Plan (1976) tried indirectly to limit the growth of office *employment* by setting limits on the development of new office *floor space*. The interest here was, and continues to be, in the impacts employment growth will have on the transportation network. The FSW index, then, is important in estimating future employment growth within new office developments. The method for estimating these employment impacts consists of dividing the known development potential, adjusted to account for market vacancy, by the FSW index to obtain an employment estimate. Forecast employment estimates will therefore be sensitive to variations in the FSW ratio applied. When estimating future employment levels for a large area such as the Core, this method should use a forecast FSW index appropriate to the planning period under consideration and the index should be applied to both the existing stock of office floor space as well as the projected additions to this space. This indicator requires monitoring on a regular basis since small changes in FSW rates can significantly alter employment forecasts.

Estimates of FSW ratios have, in the past, been produced by way of sample surveys. Five such surveys have been conducted since 1960 by a variety of researchers (City planning staff, consultants and academics). This report will summarize the findings of these previous efforts and introduce a new method which, utilizing new external data sources, yields an estimate derived from a large sample of office buildings. This method can be easily applied on an annual basis to provide a continual monitoring of the FSW index. After offering some explanations for recent trends, the implications of these findings on forecasting efforts will be explored.

2.2 A Review of Space Organization

The physical characteristics of the office have changed considerably since the Second World War. Prior to 1945, office space was characterized by private offices for decision-makers and dense collections of desks in large "pools" for clerical functions. This was an arrangement which had prevailed since the late 1800s. This organizational pattern came into question during the 1950s as critics scrutinized it from the standpoint of production performance and environmental standards. (IBI, 1975)

Also, specific office functions have changed through the introduction of technological innovations. This process actually started with the telegraph and telephone and has accelerated in the 1980s with the rapid introduction of modern office systems evolving from the development of micro computers and telecommunications as components of the office infrastructure.

Corporate and technological changes have brought about many changes in the way office space is utilized and has led to a concept called "office landscaping". Essentially, this is the concept of the large open floor plate with individual offices defined by (more or less portable) partitions. Office landscaping had a substantially different impact on office space use in North America than in Europe. The rationale in Europe was to achieve a reduction in the average floor space per worker as office space was in short supply at the end of the War. In North America the more open office design was promoted as a means of improving efficiency, better communications, group spirit and to foster more flexibility - all of which led to greater space allocations per worker. (IBI, 1975)

The flexibility offered by the office landscaping concept continues today and is more important as the development industry moves to larger floor plates and higher ceilings. The efficient and effective organization of space will grow in importance with the introduction of new communications and computing technology. Office automation, in many respects, requires the reorganization of floor space to accommodate new equipment, often leading to higher FSW values in those firms. The application of new technology in the office has increased productivity, but by and large entails the "consumption" of more space. This is especially true when the users of the technology are professional staff or managers; more space is required to accommodate the equipment used by staff. The quality of space has also become very important with the concentration of higher order job functions downtown as firms incorporate common area facilities for staff and clients, such as meeting and conference rooms.

2.3 Previous Research

2.3.1 International

The general trend, over the longer term, for major cities demonstrates growth in average FSW values. Research conducted by Kroos for the New York Metropolitan Regional Study estimated that, for all types of office employees, the average space per worker increased 20 percent between 1947 and 1958 (Cowan, et al). Throughout the '60s the average FSW in Manhattan continued to grow. This has been attributed to substantial growth of head offices in the fields of finance and business services.

In London, England the average FSW grew 15 percent (an annual rate of 1.125 percent) between 1961 and 1974. This was unexpected as there were restrictions on office development in the Central City throughout this period of time. The increase in FSW was realized through the suburbanization of certain functions (mainly clerical) which increased the proportion of managerial staff in the Core of London. One impetus for suburbanization was probably rapid rent increases resulting from the restrictions on new supply.

Variations in survey techniques, market fluctuations and the inconsistent time series of such surveys have meant that plots of historic FSW values have been scattered and difficult to interpret and directly compare. However, best fit curves for most cities have generally been upward sloping. In fact, the way in which firms organize themselves in their office space, particularly in response to crowding conditions, would suggest a "lagged response" in adjusting the FSW ratios for individual firms. Case study data of head offices in London, England show that while the response to crowded conditions is the periodic acquisition of large blocks of office space, employment grows along a fairly smooth curve. (Cowan, et al)

2.3.2 Toronto

There are numerous reasons for variations in observed FSW rates, and certainly not all firms behave in the same manner, as Cowan has shown with his case studies. In 1975 the IBI Group was retained to explore historic trends and influences on FSW rates and to conduct a survey of Toronto firms. This study indicated that in all cities examined, and for urban Canada and the United States in aggregate, average FSW ratios were increasing over time. The IBI finding of 22.9 square metres per worker was 1.5 square metres greater than survey results obtained just three years previous by Prof. Gad of the University of Toronto. The Planning and Development Department undertook a comprehensive survey in 1980 which showed an even more rapid rise to 25.0 square metres per worker.

The research undertaken in both 1975 and 1980 revealed no relationship between building age or building size and FSW rates. The IBI study did indicate significant variations between central city and suburban values in the U.S. but, at the time, the only suburban values available for Toronto were hypothetical estimates for the North Pickering new town project. As one would expect, the greatest contributor to variations in FSW is the type of occupation as well as the industry group. Prof. Gad found this to be the case in his survey of office establishments in 1971/72, and the IBI report further confirmed these results.

Within firms, the allocation of space varies considerably, with the largest offices allocated to executives and with clerical staff taking up the least amount of floor space per worker. It is apparent, therefore, that occupation mix is an extremely important factor in explaining variations in FSW. Data from Background Paper No. 2 indicate strong growth in the managerial functions which naturally contributes to increases in the average FSW ratio throughout the Core.

As well, some of the industries that showed the highest ratios of floor space per worker in both the Gad and IBI surveys belong to industry groups showing considerable growth in full-time employment in the Core in recent years, such as Financial Services.

Table 1 summarizes the results of all previous surveys of FSW ratios in the Central Core including the results of our most recent research.

Table 1
Trends In Floor Space Per Worker Ratios
1960-1985

Year	Source	Sample	Area	FSW Gross* (sq. m)
1960	City of Toronto Planning Board	4,800 firms	Downtown Planning District	19.2
1970	Metro Planning Employment Survey	38 bldgs.	Central Core	21.5
1971/72	Dr. G.H.K. Gad U of T	425 firms	Central Corridor	21.4
1975	IBI Group	51 firms	Central Core	22.9
1980	City of Toronto Planning & Development	265 bldgs.	Central Core	25.0
1983	City of Toronto Planning & Development	152 bldgs.	Central Core	25.0
1984	City of Toronto Planning & Development	162 bldgs.	Central Core	26.2
1985	City of Toronto Planning & Development	161 bldgs.	Central Core	26.0

* *Gross square metres of occupied building area - measured from outside wall to outside wall.*

3 Current Analysis

3.1 Method

Rather than conducting a sample survey of firms, the availability of a number of data sources offered the opportunity of developing a model which could be used to estimate FSW values annually. The following is a summary of the method:

Data Sources:

- City of Toronto Land Use Information System (for gross floor space devoted to office use),
- Metro Toronto Planning Department Employment Survey (for total office employment in each building), and
- Royal LePage Commercial Real Estate Services (for total net rentable floor space and vacant floor space as of June in each year in each building).

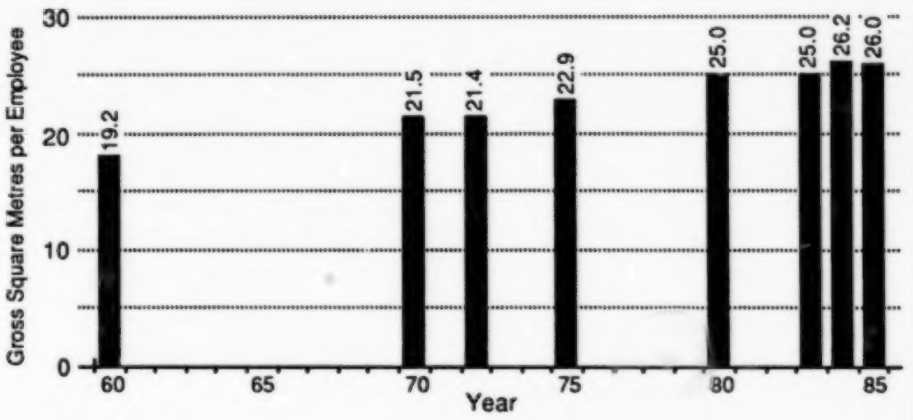
Method:

- Data from these sources were merged together to form a large sample of buildings for which all of the above variables are reliable.
- The amount of Vacant Office Space in each building, expressed as net rentable space, as a proportion of the total net rentable space represents a Vacancy Rate for each building.
- Both the Total Office Gross Floor Area and the Total Net Rentable Office Floor Area in each building are reduced by the vacancy rate to yield the amount of *occupied* floor space in both Gross and Net terms.

This analysis was conducted using data for 1983, 1984 and 1985; the results are shown in Tables 1 and 2 and Figure 1. Table 3 breaks the 1985 observations down by policy districts. The summary statistics of the total space and employment data are also presented. The vacancy rate is simply the market vacancy rate in that particular sample of buildings, which only represent a subset of all buildings contributing to the vacancy rate quoted by market analysts.

The FSW ratio has been calculated as the simple ratio of all employment in the sample to all occupied space (Gross and Net) in the sample. The FSW ratio was also calculated for each building in the sample and the median of this distribution of building-level FSW ratios is also presented on Tables 1 and 2.

Figure 1
Trends in Floor Space per Worker, Central Core
1960 - 1985



Source: See Table 1

Table 2
Floor Space Per Worker Ratios
1983 To 1985

	1983		1984		1985	
	City of Toronto	Central Core	City of Toronto	Central Core	City of Toronto	Central Core
Number of Buildings	217	152	232	162	230	161
Total Office Gross Floor Area	3,683,190	3,089,417	4,178,497	3,549,312	4,109,860	3,491,817
Occupied Office Gross Floor Area	3,502,333	2,950,077	3,806,076	3,239,817	3,798,808	3,219,104
Total Rentable Office Floor Area	3,073,783	2,575,377	3,457,876	2,930,851	3,395,514	2,877,108
Occupied Rentable Office Floor Area	2,922,785	2,459,280	3,149,766	2,675,613	3,139,377	2,652,624
Total Vacant Floor Space	150,998	116,097	304,765	255,238	256,137	224,483
Vacancy Rate	4.9%	4.5%	8.8%	8.7%	7.5%	7.8%
Total Office Employment	140,224	118,071	148,384	123,466	147,456	123,823
Gross F.S.W.[1]	**25.0**	**25.0**	**25.6**	**26.2**	**25.8**	**26.0**
Median of the distribution	26.7	26.5	28.8	28.7	28.1	27.8
Net F.S.W. [2]	**20.8**	**20.8**	**21.2**	**21.7**	**21.3**	**21.4**
Median of the distribution	23.1	22.7	23.9	23.0	23.6	22.5

1 *Gross square metres of occupied building area - measured from outside wall to outside wall*
2 *Net square metres of occupied building area - net rentable floor space as determined by leasing agents.*

Sources: *Royal LePage Ltd.*
Metro Toronto Planning Department, Research Division
City of Toronto Land Use Information System

Table 3
Floor Space Per Worker Ratios, By Policy District
1985

	Financial District	Rest of Core	Core	Rest of Central Area	Rest of City	City
Number of Buildings	66	95	161	14	55	230
Total Office Gross Floor Area	1,688,009	1,803,808	3,491,817	94,648	523,395	4,109,860
Occupied Office Gross Floor Area	1,568,258	1,650,846	3,219,104	82,723	496,832	3,798,808
Total Rentable Office Floor Area	1,406,728	1,470,380	2,877,108	71,323	447,083	3,395,514
Occupied Rentable Office Floor Area	1,306,932	1,345,693	2,652,624	62,336	424,416	3,139,377
Total Vacant Floor Space	99,796	124,687	224,483	8,986	22,667	256,137
Vacancy Rate	7.1%	8.5%	7.8%	12.6%	5.1%	7.5%
Total Office Employment	57,940	65,883	123,823	2,881	20,752	147,456
Gross F.S.W.[1]	**27.1**	**25.0**	**26.0**	**28.7**	**23.9**	**25.8**
Median of the distribution	28.1	27.2	27.8	31.7	28.5	28.1
Net F.S.W.[2]	**22.5**	**20.4**	**21.4**	**21.6**	**20.4**	**21.3**
Median of the distribution	21.7	23.2	22.5	25.0	24.6	23.6

1 Gross square metres of occupied building area - measured from outside wall to outside wall.
2 Net square metres of occupied building area - net rentable floor space as determined by leasing agents.

Sources: *Royal LePage Ltd.*
Metro Toronto Planning Department, Research Division.
City of Toronto Land Use Information System

3.2 Findings

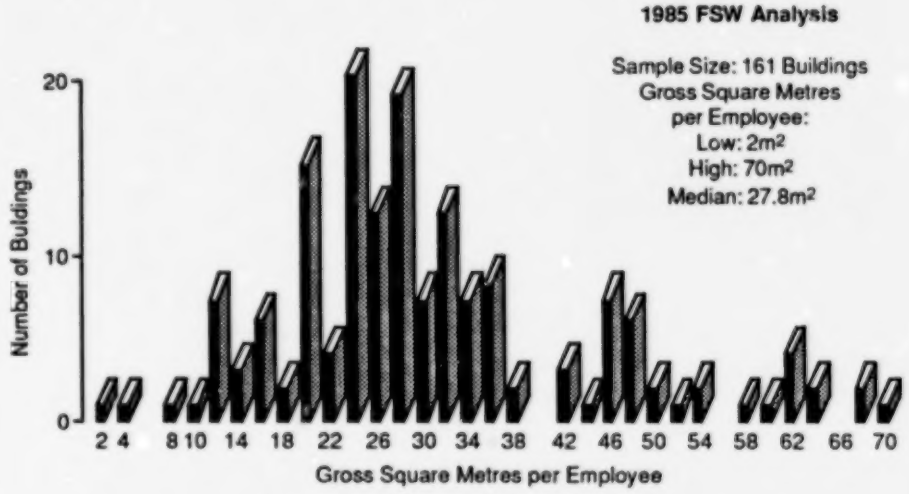
The results of the building-level FSW ratio for 1985 data in the Core Area are illustrated as a frequency distribution in Figure 2. Observed FSW values range from a low of 2.0 square metres per worker to a high of 69.2 square metres. The median, 27.8 square metres, reflects the midpoint of the distribution of 161 observations. Figure 2 clearly shows that the FSW ratios for individual buildings vary widely.

In an effort to explain the wide variance in observed FSW ratios, these values were plotted against building age, size and rental rates. No relationship was discovered. The lack of a definite pattern in this plot mirrors the results found by IBI in 1975. The key to explaining FSW ratios in detail may lie in a detailed examination of office occupancy data in which lease information is compared to employment counts. There are, however, prominent trends such as market fluctuations, the potential influence of technology and changes in the labour force which are discussed in other Background Papers, which can be interpreted as contributing to increases in the average FSW ratio in the Core.

3.3 Interpretation

Earlier studies have identified a general upward trend in the floor space per worker ratio, and current research confirms a continuation of this trend. The rise from 22.9 square metres in 1975 to 26.0 square metres in 1985 represents an average annual growth rate of 0.31 square metres per worker. In 1975, the IBI group, in their analysis of floor space occupancy trends assumed that the

Figure 2
Distribution of Sample Floor Space per Worker
Central Core
1985



Source: City of Toronto Planning and Development Department

FSW ratio in the Core would continue to rise. In fact, the 1985 observed value is just slightly higher than IBI's original (1975) projection for 1985 of 25.7 square metres, but well within their projected range (23.8 to 28.8 square metres). There are a number of reasons why the FSW ratio has been increasing including:

- strong demand for space,
- office market dynamics,
- structural employment changes, and
- office automation,

each of which is described in more detail below.

- **A Healthy Demand for Space** has meant that absorption has been outpacing the growth in office employment. Between 1981 and 1985 over 422 500 square metres of occupied office floor space were added in the Core; a considerable addition of space for a modest increase of 4,302 full-time office workers (over 98 square metres per worker).

- **Office Market Dynamics** have also been playing a significant role in the upward trend of FSW ratios. Most important has been the extremely active leasing market throughout the period

1984 to 1986. Considerable benefits such as leasehold allowances were offered to induce tenants to move into new space. The resultant dampening of real rents may have been translated into the consumption of more space. Background Paper No. 1 and office market reports indicate that 1984-1986 has been a period of major office expansion, in large part due to such generous tenant allowances in new projects. A great deal of office space has been absorbed and this demand appears to be outstripping employment growth.

These trends in supply and demand have definitely contributed to increasing FSW values averaged over the establishment and building level. However, even given increases in higher order managerial/professional functions, not all staff are necessarily being allocated more work space. The "quality" of space has become an important consideration in the demand equation and firms are giving increasing attention to common areas for staff and clients as well as to separate conference facilities. Furthermore, given the "tenant" market prevailing, firms may be committing to more space than necessary with a view toward future growth in employment.

- **Structural Employment Changes** in the labour force show high growth rates for managerial (158 percent) and scientific and technical workers (75 percent) between 1971 and 1981 (Figure 3). These occupations tend to consume more space per worker than clerical workers and hence have influenced average FSW ratios in the workplace. Many of the managerial and professional high growth group work in Downtown Toronto. The Journey-to-Work data provided in the 1971 and 1981 Census show significant increases in work trips into the Central Area on the part of managers and professionals (Table 4).

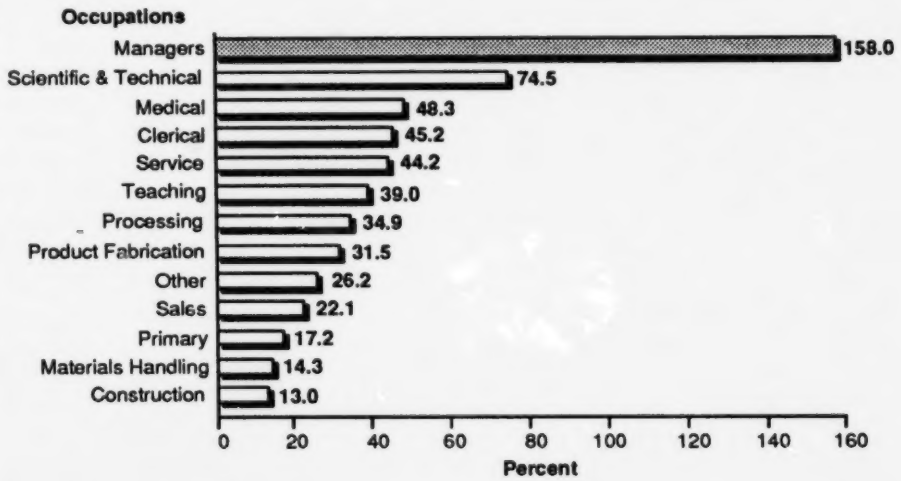
Table 4
Change In Inbound Work Trips To The Central Area from the Toronto Census Metropolitan Area

Occupational Group	1971	1981	Change #	Change %
Managerial & Non-scientific Professionals	29,661	59,930	30,269	102
Scientific Professionals	4,586	9,776	5,190	113
All Office Workers	**143,786**	**203,772**	**59,986**	**42**
Total Workers	268,006	352,720	84,714	32

Source: Census of Canada 1971, 1981

The implications of changing Journey-to-Work patterns are discussed more fully in Background Paper No. 7. These data point to the increasing importance of the Central Area as a work location for managerial and professional workers. This is an expected reflection of the growing importance Toronto has as a location of head office functions for large corporations. While considering the region of Metro Toronto as the geographic unit of importance, Semple and Green (1983) demonstrated the dominance of Toronto within the Canadian urban system as a preferred location for corporate headquarters. In the resource, manufacturing and service sectors, as well as the utility, real estate and financial sectors, more corporate relocations in Canada resulted in Toronto destinations than all other centres combined, between 1970 and 1982. Within the Toronto Region it has been suggested that there has been a trend toward the concentration of some office functions in the City's Core Area such as Financial and Business Services. This

Figure 3
Percent Growth in Labour Force by Occupation
Toronto CMA
1971 - 1981



Source: Statistics Canada

has been attributed to a continued need for face-to-face communication, and the appeal of being accessible to a number of alternative information sources, particularly in the Financial Services sector. (Gad, 1985; Code, 1983)

Changes to the Bank Act in 1981 permitted the establishment of foreign financial institutions in Canada. These firms seem to prefer the Toronto area, with many locating in the Central Core. "By February 28, 1983 over 90 percent of these foreign banks had located in Toronto.... The relocation data show that major corporations truly perceive Toronto as the city that provides the greatest national and international exposure" (Semple and Green). De-regulation of the Financial Services industry in Ontario is on the horizon. An influx of foreign investment in this sector could result in an increase in the demand for office space in the Central Core.

The trends from the 1971 and 1981 Journey-to-Work data may continue. Many institutional concerns, banks and insurance companies, have moved their "back-office" functions out of the Core to suburban locations. Such functions generally involve large clerical labour pools. Gunter Gad (1985) has documented some of the impacts of this process of "partial decentralization" which has been reinforcing the "executive city" perception of the Downtown Core. Between June 1977 and December 1985, the average asking rent in the Central Core rose from $106 per square metre to $302 per square metre which probably contributed to this partial decentralization. (Background Paper No. 1) These trends may continue as other clerical-oriented operations may not be able to compete with head office functions for the available space.

- **Technological Changes in Office Functions** have facilitated and enhanced the structural employment changes presently observed Downtown, and may have also had an influence in raising FSW ratios. New technology in computing and communications have facilitated the decentralization of back-office functions. Further, the evolution of computer technologies as systems to provide statistical services essential to management decision-making has meant that the increasing numbers of managers and professionals in the Core require more space than previously allocated.

  A case in point is Ontario Hydro which recently approached the Ontario Energy Board with plans to significantly increase floor space occupancy. Citing "professional standards" and a confidential survey of the head offices of eight similar organizations, Hydro staff claimed to be ten percent below the professional community in space allotted per employee. Senior officials with Hydro have attributed office automation with reducing the need for head office workers but also to increasing the space requirements per employee. (The Globe and Mail, June 24, 1986)

  Further technology-induced impacts will be experienced in the near future as many firms strive for greater efficiency. The most critical sector will probably be Financial Services as the Toronto-based industry attempts to remain competitive internationally. The impacts of a major restructuring of this sector in Britain have been recognized recently in a new plan for the City of London where policy statements explicitly recognize the impact that new technology is having in the demand for space. Among these are a recognition of minimum floor-to-floor heights and localized controls over heating, air conditioning and lighting that are becoming standard requirements for technologically flexible office space. A sub-committee of the City's Economic Development Committee is currently directing a number of consultant studies regarding Downtown employment trends, with particular emphasis on the impacts of technological change in the office work force.

4 Conclusions

The floor space per worker ratio in Toronto's Core continues to rise. In the Central Core the FSW over a sample of 162 buildings reached 26.2 square metres per worker in 1984. Having remained steady into 1985 (26.0 square metres), it may be that a temporary plateau has been reached. The rise in average FSW ratios between 1970 and 1984/85 can be partially attributed to four primary and inter-related influences:

(i) demand for space outstripping office employment growth,
(ii) generous tenant inducements and reduced rents which have made office space relatively more affordable,
(iii) structural change in the composition of the Central Area workforce, and
(iv) the introduction of new technology to the office environment.

The Toronto Region is the preferred choice for the location of Canadian head office functions in certain key economic sectors (resources, manufacturing, financial services and real estate) and will continue to attract new firms. Independent of technological influences, the continued need for face-to-face contact and the availability of a wider choice of information sources contributes to the concentration of higher order executive functions within these sectors on the City's Core Area. This will reinforce the current trend towards higher FSW ratios.

The influence of labour force dynamics and the technology of office automation will likely continue to impact on FSW rates by raising them. The technological impacts may possibly have the greatest influence on FSW rates in two important ways:

(a) by facilitating the decentralization of lower order (clerical) back-office functions, and

(b) by increasing the space requirements of the higher order (managerial/professional) functions that remain in the Core.

A possible effect deriving from (b) could be an increase in the demand for new office space that is more technologically suited to the decision-making function (the "smart" building). This would be most likely to arise if the older office stock was deemed unsuitable to retrofit initiatives. To the extent this proves to be the case, it appears that there will always be a certain demand for new space.

The method of determining existing FSW ratios presented in this study has the advantage of being easily replicated on a regular basis. This should facilitate the more frequent monitoring of FSW indices in the Core. Another approach, relying on detailed occupant-level data, will be evaluated in the coming months. Further enhancements to the ongoing monitoring of Toronto's office economy, which already includes tracking construction, absorption, vacancy and rent levels, should incorporate more frequent analyses of FSW levels. Related to this work should be an analysis of the Journey-to-Work data which were collected as part of the 1986 Census when this information becomes available.

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